VERIFICATION OF TRANSLATION

I, Shihua, CHEN hereby solemnly affirm that I have a fluent knowledge of English and Chinese languages and that the attached document is the true and accurate translation of the Chinese Priority application number 02125984.4.

Dated this .... 20 .... day of ..... July .... 20.0 ....

Signature of Translator... Shihua, CHEN ....

A Multi-layer User Management Method

for Multicasting Proxy

Field of the Technology

The present invention relates to a user management method for multicasting proxy in data communications, specifically to a multi-layer user management method for multicasting proxy, which belongs to application technique of access server and edge routers in data transmission field.

Background of the Invention

In prior art, multicasting can only be controlled at interface layer, but not at data link layer or user layer. In this way, members of a multicasting group are interfaces or sub-interfaces, so that there are several disadvantages: (1) a multicasting packet sender can only forward multicasting packets to interfaces without knowing anything about who will receive the multicasting packets; (2). it is not under control whether a particular user belonging to a multicasting group has the right to send multicasting packets; (3): a particular user who has sent some multicasting packets can't be precisely charged. Therefore, user level management can't be achieved at present, and it is inconvenient in practice.

Summary of the Invention

It is an object of the invention to provide a multi-layer user management method for multicasting proxy. With this method, multicasting groups can be controlled more effectively and user layer management can be achieved. For example, this method can control the right of members of multicasting groups to receive the multicasting data and apply other applications, and can charge a particular user of a multicasting group for his multicasting applications.

To achieve this object, a method according to the present invention comprises:

(1) dividing a user management for multicasting groups into three layers: management at an interface layer, management at a data link layer and management at user layer; and at each layer, setting control blocks;

(2) establishing a data relationship among the three layers of control blocks; and

1

(3) managing users of the multicasting groups through the data relationship among the three layers of control blocks.

In step (1), the management at an interface layer is for controlling multicasting characteristics corresponding to interfaces; the management at a data link layer is for controlling multicasting characteristics corresponding to data links; the management at user layer is for controlling multicasting characteristics corresponding to particular users.

Wherein, said controlling multicasting characteristics corresponding to interfaces includes: judging whether to allow multicasting applications at an interface, judging whether to allow multicasting applications at a user side or a network side, judging whether to allow tying multicasting resources or multicasting groups, limiting the number of members of a multicasting group or limiting the number of multicasting groups.

Wherein, the data link in management at a data link refers to the same shared data link to which the users locate.

Wherein, said controlling multicasting characteristics corresponding to data links is limiting the number of members of a multicasting group when employing a core edge layer network device such as an Edge Service Router (ESR), and forwarding only one multicasting packet for all members of the same multicasting group at the same data link when forwarding data.

Wherein, the data relationship in step (2) is established through a three-dimensional linking-list data structure, a linking-list structure or a relational database structure.

Wherein, the three-dimensional linking-list data structure is used for linking each control block with linking-lists or arrays; the three dimensions of the three-dimensional linking-list data structure comprise data link including interface, multicasting group and user IP.

Wherein, managing the users of the multicasting groups in step (1) comprises managing the user's joining or leaving a multicasting group and managing of forwarding multicasting report packets.

Wherein, managing the user's joining or leaving a multicasting group comprises:

2

(A) searching the interface layer control blocks, the data link layer control blocks and the user layer control blocks sequentially after receiving a multicasting report packet;

(B) finding a certain interface layer control block according to data structure of an interface of net (IFNET) having received a multicasting packet, then judging multicasting characteristics of the multicasting group which are defined in the found interface layer control block to determine whether to continue the successive processing, if so, performing the next steps; otherwise ending the processing;

(C) finding a certain data link layer control block according to the data relationship between data link layer control blocks and said interface layer control block, then judging multicasting characteristics corresponding to data links of the multicasting packet to determine whether to continue the successive processing, if so, performing the next step; otherwise ending the processing; and

(D) finding a certain user layer control block according to a multicasting group IP and user attributes, then adding, deleting or modifying corresponding user information in the user layer control block.

Wherein, managing of forwarding multicasting report packets comprises:

forwarding only one multicasting packet for all members of the same multicasting group at the same data link when forwarding data;

making data link layer devices attend multicasting management with device cluster control technique;

recording the flow of multicasting packets having been forwarded with a device forwarding program and charging the user who has received said multicasting packets.

As can be seen that, network resources of communication service providers can be effectively utilized with the invention, for example, only one datagram can be sent for all users of the same multicasting group at the same data link layer. So, the network resources can be greatly saved.

Brief Description of the Drawings

Figure 1 shows a three-dimensional linking-list control diagram for implementing multi-layer user management for multicasting proxy according to the present invention.

3

Detailed Description of the Invention

The present invention relates to a multi-layer user management for multicasting proxy, and the invention comprises the following main steps:

(1) dividing the user management for multicasting groups into the management at interface layer, the management at data link layer and the management at user layer, and respectively setting a control block or blocks at every layer, wherein a control block is indeed a data structure that respectively comprises the multicasting characteristics of multicasting groups corresponding to that layer in fact;

(2) establishing a data relationship among the above-mentioned control blocks, that is, a certain data link layer control block can be found from all interface layer control blocks and a certain user layer control block can be found from all data link layer control blocks; and

(3) performing user management for users, such as authentication, authorization and charge etc., with the data relationship among three kinds of control blocks.

Among the three layers of control blocks in first step, the interface layer control block is the interface/sub-interface control block according to the prior art. The interface layer control blocks are used to manage multicasting characteristics of every interface and sub-interface in a system. This management includes: whether to allow multicasting application, whether to allow multicasting applications at a user side or a network side, whether to allow tying multicasting resources or multicasting groups, limiting the number of members of a multicasting group or the number of multicasting groups etc..The data link layer control blocks are used to manage multicasting characteristics corresponding to the data link layer of a network. A data link here is a shared link where all users applying multicasting group applications located, such as a Virtual Local Area Network ID (VLAN ID) in an IPOEOVLAN, a Permanent Virtual Connection (PVC) in an IPOEOA etc.. For Point-to-Point Protocol (PPP), every user is an independent data link. The management for multicasting characteristics corresponding to the data link layer includes, for example, limiting the number of members of a multicasting group when applying a core edge network device such as an Edge Service Router (ESR), or forwarding only one datagram for all members of the same multicasting group at the same data link to save the resources of network bandwidth etc..The user layer control blocks are used to manage multicasting characteristics at user level, which includes two main aspects: managing user's

joining or leaving a multicasting group and managing of charging a particular user and forwarding multicasting packets, which will be described in more detail later.

Here, the user layer control blocks managing of forwarding multicasting packets refers to: multicasting group members in the same data link where the sender is located, only one multicasting packet is sent to the members; and for general multicasting group members, with cluster technique a data link layer device can attend the management of multicasting and devices for forwarding multicasting packets can be controlled. Therefore, after the data relationship among three layers of control blocks has been established, the accurate control at user level can be achieved. During forwarding a multicasting packet, the devices for forwarding multicasting packets will record the data flow, so multicasting application of a particular user can be recorded and the user can be charged.

As for the management for user's joining or leaving a multicasting group, it includes:

(A) searching the interface layer control blocks, the data link layer control blocks and the user layer control blocks sequentially after receiving a multicasting report packet. A specific processing is as follows;

(B) according to the IFNET that has received the multicasting report packets, a certain interface multicasting control block, i.e. a certain interface layer control block, will be found and characteristics of the multicasting group will be judged to determine whether the successive processing will be continued; if so, process the next steps, otherwise not process the next steps;

(C) According to the linked-lists under the interface control blocks and the data link characteristics of the received packets, a certain data link layer control block will be found and the data link characteristics of the multicasting group will be determined. If the multicasting application can be applied at this data link, process the next step; otherwise not process the next step. If no data link layer control block can be found, then a new data link control block can be added at that data link;

(D) According to the multicasting group IP and user attributes (such as user identification), a certain user layer control block will be found, then the management of user's joining or leaving the multicasting group will be made, that is, corresponding user information can be added, deleted or modified in the user layer control block.

The second step of the present invention, that is, how to establish the data relationship among three kinds of control blocks, is a key point of the invention. A

three-dimensional linking-list can be used to establish the above-mentioned data relationship, and other linking-list structures or a database structure etc. can be used instead. Figure1 shows the structure of a three-dimensional linking-list. The three dimensions are data link (including interface), multicasting group and user IP. In detail, since all control blocks are linked with linking-lists or arrays, every user layer control block can be searched through any of the data link (including interface), the multicasting group and the user ID. The index relationship ensures three-level management can be achieved with the data structure, that is, multicasting characteristics can be respectively managed at interface level, data link layer and user layer. In this way, the management for multicasting groups can be flexible and effective.

Reference to Fig.1, the interface of net (IFNET) is a network interface control block for recording interface information. The interface layer control blocks according to the invention, i.e. the interface multicasting control blocks as shown in Fig.1, are linked to the IFNET. In other words, an index mode for multicasting groups is added in the IFNET with a pointer. In this way, interface control blocks can be effectively managed by means of the management module for interfaces in the operating system of a network device. Also as shown in Fig.1, the control blocks L1, L2, L3 and L4 at data link layer and control blocks G1,G2 and G3 at user layer are respectively the data link layer control blocks for data links 1, 2, 3 and 4 and the user layer control blocks for multicasting groups 1, 3 and 4. The data link layer control blocks and user control blocks are respectively used to establish the index relationship between data link layer and users and between multicasting group IPs and users. By means of the two index relationships, a particular user can be searched and fixed on by either the data link layer or multicasting group IP. The hash table of data link layer and the hash table of multicasting group IP can be used to increase searching efficiency. In detail, corresponding key of the hash table can be quickly calculated with particular hash arithmetic for data link index or multicasting group IP. Next, a particular data link layer control block or user layer control block can be found through hash table index with keys.

6

Claims

1. A multi-layer user management method for multicasting proxy, comprising:

(1) dividing a user management for multicasting groups into three layers: management at an interface layer, management at a data link layer and management at user layer, and at each layer, setting control blocks;

(2) establishing a data relationship among the three layers of control blocks; and

(3) managing users of the multicasting groups through the data relationship among the three layers of control blocks.

2. The method of Claim 1, wherein the management at an interface layer is for controlling multicasting characteristics corresponding to interfaces; the management at a data link layer is for controlling multicasting characteristics corresponding to data links; the management at user layer is for controlling multicasting characteristics corresponding to particular users.

3. The method of Claim2, wherein said controlling multicasting characteristics corresponding to interfaces includes: judging whether to allow multicasting applications at an interface, judging whether to allow multicasting applications at a user side or a network side, judging whether to allow tying multicasting resources or multicasting groups, limiting the number of members of a multicasting group or limiting the number of multicasting groups.

4. The method of Claim 2, wherein the data link in management at a data link refers to the same shared data link to which the users locate.

5. The method of Claim2, wherein said controlling multicasting characteristics corresponding to data links is limiting the number of members of a multicasting group when employing a core edge layer network device such as an Edge Service Router (ESR), and forwarding only one multicasting packet for all members of the same multicasting group at the same data link when forwarding data.

6. The method of Claim1, wherein the data relationship is established through a three-dimensional linking-list data structure, a linking-list structure or a relational database structure.

7. The method of Claim6, wherein the three-dimensional linking-list data structure is used for linking each control block with linking-lists or arrays; the three

dimensions of the three-dimensional linking-list data structure comprise data link including interface, multicasting group and user IP.

8. The method of Claim2, wherein managing the users of the multicasting groups comprises managing the user's joining or leaving a multicasting group and managing of forwarding multicasting report packets.

9. The method of Claim 8, wherein managing the user's joining or leaving a multicasting group comprises:

(A) searching the interface layer control blocks, the data link layer control blocks and the user layer control blocks sequentially after receiving a multicasting report packet;

(B) finding a certain interface layer control block according to data structure of an interface of net (IFNET) having received a multicasting packet, then judging multicasting characteristics of the multicasting group which are defined in the found interface layer control block to determine whether to continue the successive processing, if so, performing the next steps; otherwise ending the processing;

(C) finding a certain data link layer control block according to the data relationship between data link layer control blocks and said interface layer control block, then judging multicasting characteristics corresponding to data links of the multicasting packet to determine whether to continue the successive processing, if so, performing the next step; otherwise ending the processing; and

(D) finding a certain user layer control block according to a multicasting group IP and user attributes, then adding, deleting or modifying corresponding user information in the user layer control block.

10. The method of Claim8, wherein managing of forwarding multicasting report packets comprises:

forwarding only one multicasting packet for all members of the same multicasting group at the same data link when forwarding data;

making data link layer devices attend multicasting management with device cluster control technique;

recording the flow of multicasting packets having been forwarded with a device forwarding program and charging the user who has received said multicasting packets.

Abstract

Disclosed is a multi-layer user management method for multicasting, including: (1) a user management for multicasting groups is divided into three layers: management at an interface layer, management at a data link layer and management at user layer, and at each layer control blocks that are respectively comprised of data corresponding to said each layer are set; (2) a data relationship among the three layers of control blocks is established; (3) particular users of the multicasting groups are managed through the data relationship among the three layers of control blocks. Advantages of the invention are: first network resource of a network operator is effectively used, such as multicast group members on a same link where the sender is located only sending a multicast packet is enough; technical manner for managing such as user authentication and charging is provided, and an accurate charging of a user multicast application is based on duration and flow of the multicast packets.
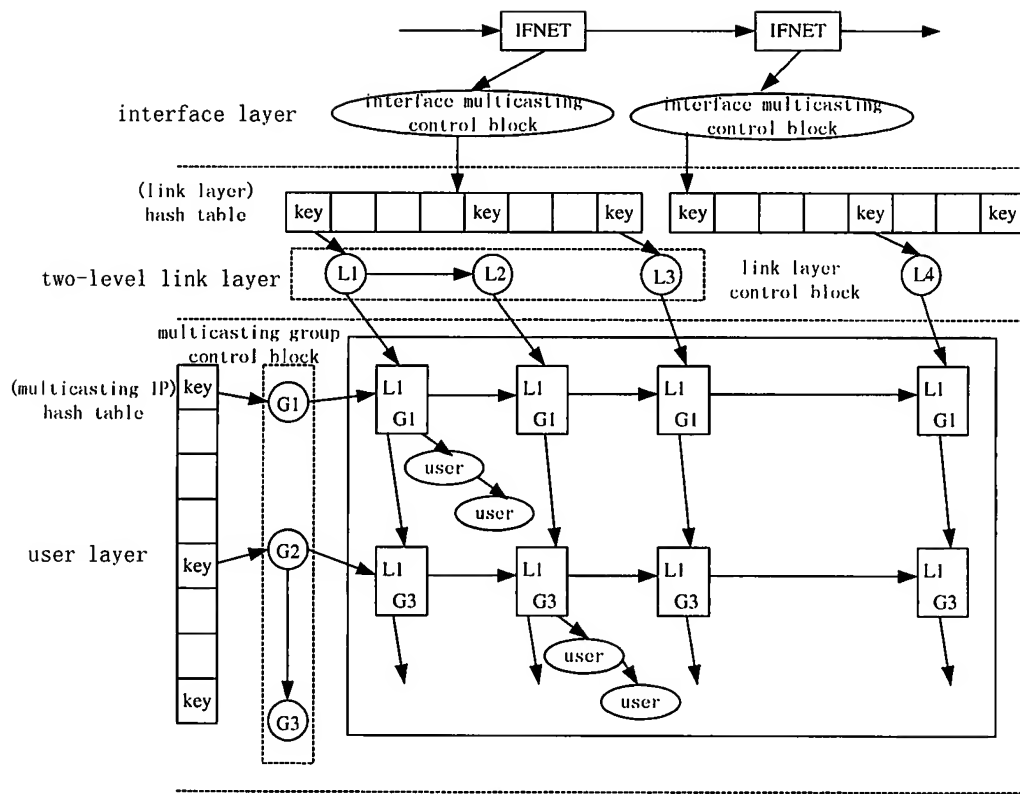
Fig.1